RECEIVED
CENTRAL FAX CENTER

MAY 0 2 2006

Practitioner's Docket No. 2460 ***PATENT***

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Youichi Akasaka	Confirmation No: 7660
Serial No.:	10/655,901	Examiner: Deandra M. Hughes
Filing Date:	09/05/2003	Group Art Unit: 3663
Title:	DISTRIBUTED RAMAN AMPLIFICATION	

Mailstop: Appeal Brief - Patents
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

Introductory Comments

Pursuant to the provisions of 37 C.F.R. § 41.30 *et seq.*, the Assignee hereby appeals to the Board of Patent Appeals and Interferences (hereinafter "the Board") from the claim rejections issued in the final Office action dated February 10, 2006. A notice of appeal was filed on the same day as this appeal brief.

Real Party In Interest

The entire interest in the present application has been assigned to Sprint Communications Company, L.P. (hereinafter "the Assignee"), as recorded at Reel 014195, Frame 0123.

Related Appeals and Interferences

There are no prior or pending related appeals or interferences.

05/04/2006 AWONDAF1 00000029 210765 10655901
02 FC:1402 500.00 DA

Status of Claims

Claims 1, 4-11 and 14-20 are pending in the application.

Claims 2, 3, 12 and 13 are canceled.

Claims 1, 4-11 and 14-20 have been finally rejected.

Claims 1, 4-11 and 14-20 are being appealed.

Status of Amendments

No amendments have been filed subsequent to the final rejections.

Summary of Claimed Subject Matter

Independent claim 1 provides a communication system 300 for distributed amplification of optical signals. (Fig. 3; and page 8, line 15, to page 11, line 9.) Included in the system 300 are a first fiber span 302, a second fiber span 306, and a third fiber span 310. (Page 8, lines 16-19.) A first pump system 320 is configured to generate and transmit a first light beam. (Page 9, line 12.) A first splitter 316 is configured to receive the first light beam, split the first light beam into a first portion of the first light beam and a second portion of the first light beam, transfer the first portion of the first light beam onto the first fiber span 302 to backward propagate over the first fiber span 302, and transfer the second portion of the first light beam onto the second fiber span 306 to forward propagate over the second fiber span 306. (Page 9, lines 13-18.)

Also included is a second pump system 321 configured to generate a second light beam. (Page 9, line 19.) A second splitter 317 is configured to receive the second light beam, split the second light beam into a first portion of the second light beam and a second portion of the second light beam, transfer the first portion of the second light beam onto the second fiber span 306 to backward propagate over the second fiber span 306, and transfer the second portion of the second light beam onto the third fiber span 310 to forward propagate over the third fiber span 310. (Page 9, line 20, to page 10, line 2.)

In the system 300, a power of the first portion of the first light beam is not equal to a power of the second portion of the first light beam (page 9, lines 13 and 14), and a power of the first portion of the second light beam is not equal to a power of the second portion of the second light beam (page 9, lines 20 and 21).

Independent claim 11 provides a method of operating a communication system, such as, for example, communication system 300 described above, for distributed Raman amplification of optical signals, wherein the communication system comprises a first fiber span, a second fiber span, a third fiber span, a first pump system, a first splitter system, a second pump system, and a second splitter system.

In the method of claim 11, optical signals are received in the first, second, and third fiber spans. (Page 9, lines 9-11.) In the first pump system, a first light beam is generated, and the first light beam is transmitted to the first splitter system. (Page 9, line 12.) In the first splitter system, the first light beam is received from the first pump system and split into first and second portions. (Page 9, lines 13 and 14.) The first portion of the first light beam is transferred onto the first fiber span to backward propagate over the first fiber span. (Page 9, lines 14-16.) The second portion of the first light bean is transferred onto the second fiber span to forward propagate over the second fiber span. (Page 9, lines 16-18.)

In the second pump system, a second light beam is generated and transmitted to the second splitter system. (Page 9, line 19.) In the second splitter system, the second light beam is received from the second pump system and split into first and second portions. (Page 9, lines 19 and 20.) The first portion of the second light beam is transferred onto the second fiber span to backward propagate over the second fiber span. (Page 9, lines 21-23.) The second portion of the second light beam is transferred onto the third fiber span to forward propagate over the third fiber span. (Page 9, line 23, to page 10, line 2.)

In this method, a power of the first portion of the first light beam is not equal to a power of the second portion of the first light beam (page 9, lines 13 and 14), and a power of the first portion of the second light beam is not equal to a power of the second portion of the second light beam (page 9, lines 20 and 21).

Grounds of Rejection to Be Reviewed on Appeal

1. Claims 1, 4, 11 and 14 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,344,922 to Grubb et al. (hereinafter "Grubb") in view of C.R.S. Fludger, V. Handerek and R.J. Mears, "Pump to signal RIN transfer in Raman fibre amplifiers," *Electronics Letters*, vol. 37, no. 1, pp. 15-17 (January 4, 2001) (hereinafter "Fludger").
2. Claims 5, 6, 8, 15, 16 and 18 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Grubb in view of Fludger and U.S. Patent No. 6,603,593 to Fidric et al. (hereinafter "Fidric").
3. Claims 7, 9, 10, 17, 19 and 20 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Grubb in view of Fludger and "Fiber-Optic Communication Systems" by Agrawal (hereinafter "Agrawal").

Argument

Outline

I. Preliminary Discussion of the Fludger Reference

II. Rejection of Claims 1, 4, 11 and 14 Under 35 U.S.C. § 103(a)

- A. Claims 1 and 11 Are Allowable Because Fludger Does Not Teach or Suggest Unequal Powers for the First and Second Portions of a Light Beam
- B. Claims 1 and 11 Are Allowable Because No Motivation Exists to Combine Grubb and Fludger
- C. Claims 4 and 14 Are Allowable Because Each Depends from an Allowable Independent Claim

III. Rejection of Claims 5-10 and 15-20 Under 35 U.S.C. § 103(a)

- A. Claims 5-10 and 15-20 Are Allowable Because Each Depends from an Allowable Independent Claim

I. Preliminary Discussion of the Fludger Reference

Fludger provides "[a]n analytical model and measurements of the pump to signal relative intensity noise [RIN] transfer characteristics of co- and counter-pumped Raman amplifiers...." (Abstract.) More specifically, Fludger provides theoretical equations for determining RIN in a co-pumped (i.e., forward pumped) amplifier (equation (2)), and a counter-pumped (i.e., backward pumped) amplifier (equation (3)). The veracity of these equations is then exhibited by way of experiment using separate co-pumped and counter-pumped configurations. (Right-hand column of page 16.) On the basis of these equations, Fludger determines that "the counter-pumped configuration is significantly more tolerant of pump noise than the co-pumped configuration."

However, while Fludger discusses RIN transfer characteristics of systems employing *either* co-pumped *or* counter-pumped Raman amplifiers, at no point does Fludger address the effect on RIN if *both* forward *and* reverse pumping are performed simultaneously on the same fiber span.

II. Rejection of Claims 1, 4, 11 and 14 Under 35 U.S.C. § 103(a)

Claims 1, 4, 11 and 14 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Grubb in view of Fludger. (Page 2 of the final Office action.) The final Office action indicates that "Grubb does not specifically disclose an unequal power distribution between the forward and counter propagating pumps. Fludger teaches the effects of pump propagation direction on RIN transfer (entire article). It would have been obvious to one of ordinary skill (e.g., an optical engineer) in the art at the time the invention was made to unequally distribute the power of the forward and backward propagating signal for the advantage of minimizing RIN transfer." (Page 3 of the final Office action.) In response, the Assignee respectfully traverses the rejections, as discussed below.

A. Claims 1 and 11 Are Allowable Because Fludger Does Not Teach or Suggest Unequal Powers for the First and Second Portions of a Light Beam

As indicated above, Fludger does not discuss the effect on RIN if both forward and reverse pumping are performed simultaneously. Thus, Fludger does not teach or suggest the possibility of forward and backward pumping simultaneously, much less *unequal* forward and backward pumping.

Additionally, whether the equations presented by Fludger are applicable to systems involving simultaneous forward and reverse pumping is an open question, as Fludger does not recognize the possibility of such a system. Some interaction between forward and reverse pumping with respect to RIN may indeed occur, and the resulting effect on RIN cannot be determined on the basis of Fludger. For example, while Fludger indicates that counter-pumping alone results in lower RIN than solely co-pumping, using more counter-pumping than co-pumping may not necessarily result in lower RIN, as such a result cannot necessarily be ascertained from the Fludger equations. In fact, forward and reverse-pumping simultaneously, regardless of the relative powers involved, may result in a higher RIN than pumping solely in either the forward or reverse directions.

The advisory action of April 14, 2006, further indicates that the final Office action never stated that Fludger teaches both forward and reverse pumping, and that Fludger is relied upon merely for the teaching of "the effects of pump propagation direction on RIN transfer." (Page 2 of the advisory action.) However, since Fludger does not teach the effects of pump propagation on RIN transfer in a system that employs both forward and backward pumping, Fludger provides no advice as to how to adjust forward and reverse pump powers to minimize RIN in such a system. Thus, Fludger cannot teach or suggest using unequal powers for the first and second portions of each of the first light beam and the second light beam, as provided for in claims 1 and 11.

Moreover, while claims 1 and 11 describe a system and a method in which a power of a forward-propagating light beam is most likely unequal to a power of a reverse-propagating light beam over the same fiber span, the limitation in question actually provides for unequal powers of the first and second portions of each light beam, which are *propagated over different fiber spans*. For example, the first portion of the

first light beam, which backward propagates over the *first* fiber span, is unequal in power to the second portion of the first light beam, which forward propagates over the *second* fiber span. Grubb does not appear to teach or suggest such an uneven split of a single beam. Further, as Fludger is focused on determining RIN over a single fiber span, Fludger also does not appear to address these provisions of claims 1 and 11.

Thus, based on the foregoing, the Assignee contends that no combination of Grubb and Fludger teaches "a power of the first portion of the first light beam is not equal to a power of the second portion of the first light beam," or "a power of the first portion of the second light beam is not equal to a power of the second portion of the second light beam," as provided for in claims 1 and 11. The Assignee thus contends that claims 1 and 11 are allowable for at least these reasons, and such indication is respectfully requested.

B. Claims 1 and 11 Are Allowable Because No Motivation Exists to Combine Grubb and Fludger

Also, as mentioned above, Fludger concludes that, on the basis of the equations presented therein, if RIN is problematic, counter-pumping is favored over co-pumping, since "the counter-pumped configuration is significantly more tolerant of pump noise than the co-pumped configuration." (See Fig. 2, and the last paragraph of page 16.) Such a determination is inherently incompatible with the system of Grubb, in which *both* forward-pumping and reverse-pumping are implemented simultaneously over a single length of fiber. Thus, Fludger in fact *teaches away* from combined forward- and reverse-pumping. Therefore, no motivation exists to combine Grubb and Fludger, and such indication is respectfully requested.

In response, the advisory action indicates that "Fludger does not state that single pumping is preferable over combined pumping. It merely states that counter-pumping is favored over co-pumping. Further, Fludger's equations themselves illustrate that the effect of co-pumping and counter-pumping can be analyzed independently. ... Further, Fludger never addresses the equations' exclusive use to a single pumping configuration. Since simultaneous pumping of Raman amplifiers is ubiquitous in the art and Fludger does not specifically indicate that the equations can not be used for such a configuration,

a plain reading of the Fludger reference would indicate that the equations (2) and (3) apply to all combinations of co-pumping and counter-pumping." (Page 2 of the advisory actions.)

The Assignee respectfully disagrees for several reasons. Fludger's equations do *not* illustrate that the effects of co-pumping and counter-pumping can be analyzed independently. Equation (2) is specifically presented as applying to "a co-pumped Raman amplifier," while equation (3) is "for a counter-pumped amplifier." (See the bottom of the first column of page 16.) Further, Fludger *does not indicate how the two equations could be combined* to yield an overall RIN value for a system that is both co- and counter-pumped simultaneously. Thus, in light of this omission, a plain reading of Fludger cannot indicate that equations (2) and (3) apply to systems that are co-pumped and counter-pumped simultaneously.

Thus, the Assignee respectfully asserts that independent claims 1 and 11 are allowable in view of any combination of Grubb and Fludger for at least these additional reasons, and such indication is respectfully requested.

C. Claims 4 and 14 Are Allowable Because Each Depends from an Allowable Independent Claim

Claim 4 depends from independent claim 1, and claim 14 depends from independent claim 10. Thus, each of these claims incorporates the provisions of its associated independent claim. Therefore, the Assignee asserts that claims 4 and 14 are allowable for at least the same reasons provided above in support of claims 1 and 11, and such indication is respectfully requested.

III. Rejection of Claims 5-10 and 15-20 Under 35 U.S.C. § 103(a)

Claims 5, 6, 8, 15, 16 and 18 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Grubb in view of Fludger and Fidric. (Page 4 of the final Office action.) Also, claims 7, 9, 10, 17, 19 and 20 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Grubb in view of Fludger and Agrawal. The Assignee

respectfully traverses these rejections on the basis of the foregoing discussion regarding the allowability of independent claims 1 and 11.

A. Claims 5-10 and 15-20 Are Allowable Because Each Depends from an Allowable Independent Claim

Claims 5-10 depend from independent claim 1, and claims 15-20 depend from independent claim 11. Thus, claims 5-10 and 15-20 incorporate the provisions of their respective independent claim. Hence, the Assignee asserts that claims 5-10 and 15-20 are allowable for at least the reasons set forth above with respect to claims 1 and 11, and such indication is respectfully requested.

Conclusion

In light of the foregoing remarks, the Assignee submits to the Board that the final rejection of claims 1, 4-11 and 14-20 is erroneous, and respectfully requests its reversal.

The Office is hereby authorized to charge Deposit Account No. 21-0765 the requisite fees for this appeal brief (37 C.F.R. 41.20(b)(2)) and its associated notice of appeal (37 C.F.R. 41.20(b)(1)). The Assignee believes that no additional fees are due with respect to this filing. However, should the Office determine that additional fees are necessary, the Office is hereby authorized to charge Deposit Account No. 21-0765.

Respectfully submitted,

Date: 5/2/06

Kyle J. Way, Reg. No. 45,549
Setter Ollila LLC
Telephone: (303) 938-9999 ext. 21
Facsimile: (303) 938-9995

Correspondence address:

CUSTOMER NO. 28004

Attn: Harley R. Ball
6391 Sprint Parkway
Mailstop: KSOPHT0101-Z2100
Overland Park, KS 66251-2100

Claims Appendix

The following is a list of claims involved in this appeal:

1. A communication system for distributed Raman amplification of optical signals, the communication system comprising:

a first fiber span;

a second fiber span;

a third fiber span;

a first pump system configured to generate and transmit a first light beam;

a first splitter configured to receive the first light beam, split the first light beam into a first portion of the first light beam and a second portion of the first light beam, transfer the first portion of the first light beam onto the first fiber span to backward propagate over the first fiber span, and transfer the second portion of the first light beam onto the second fiber span to forward propagate over the second fiber span;

a second pump system configured to generate and transmit a second light beam; and

a second splitter configured to receive the second light beam, split the second light beam into a first portion of the second light beam and a second portion of the second light beam, transfer the first portion of the second light beam onto the second fiber span to backward propagate over the second fiber span, and transfer the second portion of the second light beam onto the third fiber span to forward propagate over the third fiber span;

wherein a power of the first portion of the first light beam is not equal to a power of the second portion of the first light beam; and

wherein a power of the first portion of the second light beam is not equal to a power of the second portion of the second light beam.

(Claims 2 and 3 are canceled.)

4. The communication system of claim 1 wherein the first pump system and the second pump system are configured to generate at least a 6 dB gain in the second fiber span.

5. The communication system of claim 1 wherein the first pump system comprises at least one laser diode configured to generate the first light beam.

6. The communication system of claim 1 wherein the first splitter system comprises about a 3 dB splitter.

7. The communication system of claim 1 wherein the first fiber span comprises a span of transmission fiber having a length between about 50 km and 120 km.

8. The communication system of claim 1 wherein the first portion of the first light beam comprises between about 40 to 49.5 percent or 51.5 to 60 percent of the power of the first light beam.

9. The communication system of claim 1 wherein the power of the first portion of the first light beam is less than about 300 mW.

10. The communication system of claim 1 wherein the power of the second portion of the first light beam is less than about 300 mW.

11. A method of operating a communication system for distributed Raman amplification of optical signals, wherein the communication system comprises a first fiber span, a second fiber span, a third fiber span, a first pump system, a first splitter system, a second pump system, and a second splitter system, the method comprising:

receiving the optical signals in the first fiber span, the second fiber span, and the third fiber span;

in the first pump system,

generating a first light beam, and

transmitting the first light beam to the first splitter system;

in the first splitter system,

receiving the first light beam from the first pump system,

splitting the first light beam into a first portion of the first light

beam and a second portion of the first light beam,

transferring the first portion of the first light beam onto the first fiber span to backward propagate over the first fiber span, and

transferring the second portion of the first light beam onto the second fiber span to forward propagate over the second fiber span;

in the second pump system,

generating a second light beam, and

transmitting the second light beam to the second splitter system; and

in the second splitter system,

receiving the second light beam from the second pump system,

splitting the second light beam into a first portion of the second light beam and a second portion of the second light beam,

transferring the first portion of the second light beam onto the second fiber span to backward propagate over the second fiber span, and

transferring the second portion of the second light beam onto the third fiber span to forward propagate over the third fiber span;

wherein a power of the first portion of the first light beam is not equal to a power of the second portion of the first light beam; and

wherein a power of the first portion of the second light beam is not equal to a power of the second portion of the second light beam.

(Claims 12 and 13 are canceled.)

14. The method of claim 11 wherein the first pump system and the second pump system are configured to generate at least a 6 dB gain in the second fiber span.

15. The method of claim 11 wherein the first splitter system comprises about a 3 dB splitter.

16. The method of claim 11 wherein the first pump system comprises at least one laser

diode configured to generate the first light beam.

17. The method of claim 11 wherein the first fiber span comprises a span of transmission fiber having a length between about 50 km and 120 km.

18. The method of claim 11 wherein the first portion of the first light beam generated by the first splitter system comprises between about 40 to 49.5 percent or 51.5 to 60 percent of the power of the first light beam.

19. The method of claim 11 wherein the power of the first portion of the first light beam is less than about 300 mW.

20. The method of claim 11 wherein the power of the second portion of the first light beam is less than about 300 mW.

Evidence Appendix

No other evidence has been submitted by the Assignee or entered by the Examiner.

Related Proceedings Appendix

There are no prior or pending related appeals or interferences.